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Energy Efficiency and Renewable Energy: What is the Potential?

Testimony of Daniel L.Sosland.
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Mr. Chairman and Members of the Committee:

My name is Daniel L. Sosland. I am the Executive Director of Environment Northeast (ENE), an environmental advocacy and research organization based in Connecticut and Maine. ENE works at the state level to promote sound energy and climate mitigation policies. Thank you for the opportunity to testify today on the potential for energy efficiency and renewable energy. My testimony will focus on the impact and potential for energy efficiency in Connecticut with some references to the rest of New England and the opportunities for a growing role for clean energy.

Why did Connecticut make a commitment to energy efficiency and renewables?

In 2000, like many states in the Northeast, Connecticut chose to restructure its electric utility system. Connecticut was grappling with a series of issues: high energy costs, antiquated power plants, system reliability and poor air quality. In enacting its Electric Restructuring Act, Connecticut also sought to make its electric system more efficient and less polluting by:

- establishing an $86 million a year fund to provide programs for commercial, industrial and residential customers. This fund built on a 10 year history in the state of developing sound programs that cost-effectively invested ratepayer funds to make Connecticut homes, businesses and government more efficient.
- creating a new Clean Energy Fund, collecting up to $30 million annually, to invest in bringing new clean energy technologies to the marketplace. The combined funds made Connecticut the state with the highest per capita spending on energy efficiency and renewable energy development.
- including provisions to require purchases of clean energy by electricity suppliers through a Renewable Portfolio Standard.

Much of the impetus for these provisions came from environmental advocates like those of us at Environment Northeast. Critics of these provisions suggested that the energy efficiency funds could not be spent because the opportunities did not exist. They complained about added costs as well.

In fact, as the state Conservation and Load Management Fund (C&LM Fund) has progressed, the programs it supports are oversubscribed. Demands on the funds are huge – as are the benefits. Skeptics from different walks of life now recognize and support this effort – indeed some of the most skeptical entities are now among the fund's biggest boosters. Regulators see the value of these investments for reducing consumer costs and addressing the state's constrained electric system. The environmental benefits are valued as a cost-effective way to help improve the state's poor air quality, which, among other things, is a significant constraint on economic growth. Individual businesses extol the value of the programs to their ability to lower energy costs, improve productivity and in many cases retain or expand jobs. In the recently completed state climate change stakeholder process, energy efficiency and renewable policies received unanimous support from business, state and academic interests. The lesson learned in Connecticut is that there is enormous potential for energy efficiency. Efficiency is a low cost way not only for environmental improvement, but for economic stimulus. It is a tool ready and available to reduce energy costs and help business be more productive. This lesson is now influencing new approaches to pursuing energy efficiency, including, in a nationally significant precedent, the regional system grid operator, ISO-New England.

What are the benefits of energy efficiency and how is it captured in Connecticut?

Energy efficiency reduces the energy used by customer end-use devices and systems, without affecting the level of service and without loss of amenities. It is not turning out the lights. Electric energy savings and peak load reductions are achieved by substituting technically more advanced equipment and processes to produce the same or an improved level of end-use service with less electricity. All programs must meet cost-effectiveness tests so that they produce net savings over time. Connecticut sought to obtain these benefits:

- Reduce load, peak demand & energy use
- Provide direct cost savings to consumers and businesses
- Lower market prices for all consumers by mitigating peak demand costs
- Mitigate market and fuel price volatility
- Reduce security risks and interruptions
- Improve air quality and allow room for economic growth
- Substitute local jobs for fuel purchases
- Mitigate climate change.

Connecticut captures these benefits through several approaches.

Ratepayer Funded Conservation and Load Management Programs

The Conservation and Load Management Fund (C&LM) offers a comprehensive array of programs tailored to residential, commercial, industrial and governmental customers. The programs are designed under the guidance of a stakeholder board, the Energy

Conservation Management Board (ECMB), representing business, environmental and consumer interests, and administered by the two distribution utilities-The Connecticut Light and Power Company and The United Illuminating Company.

Programs range from incentives for purchasing efficient products like lighting and air conditioners to assistance in making planned new construction and major renovation projects more energy efficient. Special programs are offered to low income customers. Connecticut has also developed an effective RD&D program with a portion of the funds.

The programs are screened through a rigorous cost-effectiveness test that is required by statute. Every dollar collected is required to provide more than a dollar in benefits to the electric system. The cost-benefit test compares the benefits of the efficiency measure to the costs. In many cases, the benefit to cost ratios exceed 3. New commercial and industrial construction programs produce benefit to cost ratios in the 4 – 6 range. Connecticut uses two tests: the "electric system test" and the "total resource test". The electric system test compares the present value of future program electric savings to present conservation fund expenditures. The total resource test compares the present value of future electric system and other customer savings (from other fuels or benefits) to the total of the conservation expenditures and customer costs necessary to implement the programs. Programs are regularly evaluated for their quantitative effectiveness

The programs are designed to address and overcome market barriers for consumers and market participants, such as:

- Lack of information or search costs, hassle and transaction costs, performance uncertainties, market response uncertainties, asymmetric information and opportunism,
- Product or service unavailability, organizational practices or customs,
- Split incentives, inseparability of product features, irreversibility, the failure of market prices to reflect the time-differentiated nature of demand and energy use, and the failure of market prices to reflect the full cost of energy to society
- Significant institutional barriers as well, including developing market rules focused on supply resources or on shorter-term demand response.

Programs seek to leverage their financial resources by focusing on "market timing" events – decision points when consumers enter the market to purchase products or design buildings. When a consumer is ready to purchase a motor, lighting or build an addition, the programs seek to induce the purchase or design of efficient products by paying all or a substantial portion of the incremental cost of the efficiency measures. This approach seeks to avoid the problem of lost opportunities: once a product is purchased, it will remain in use for its lifetime. When a building is built, it will stand for 30 years or more. By capturing the opportunities when they occur, the programs seek to ensure that they are not lost for the useful lives of the equipment or structures.

Types of Measures Installed

Technologies installed range from lighting and cooling systems, to building envelopes, motors and design changes to plant facilities. For example, in commercial buildings, some of the biggest savings occur from installing lighting systems (lamps, ballasts and controls can save up to 50% of lighting load); updating HVAC (heating, ventilation and air conditioning) systems; replacing inefficient office equipment and testing and sealing air ducts. Reductions from 15-50% will occur with these changes with payback periods ranging from less than 1 to 5 years typically. The cost of the effective measures is less than 3 cents/kwh.

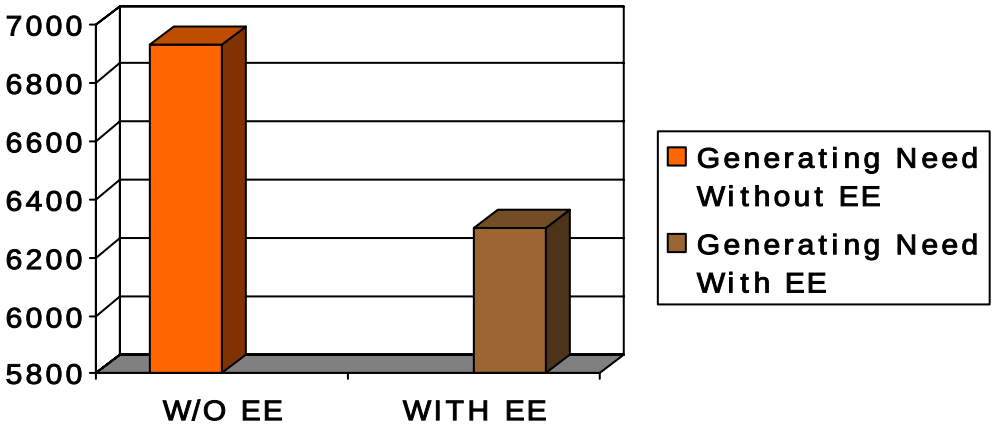
Two program examples – both have won ACEEE Exemplary Program Awards

1. Custom Services: Vendors approach fund managers with specific projects in mind and the program offers incentives to cover the incremental cost of upgraded efficiency measures.

2. RD&D: Provides funds for innovative electric efficiency and distributed resources for projects that have not been commercially proven. Funded projects include fuel cell manufacturing technology and residential heat pump clothes dryer. Projects are screened and evaluated by a stakeholder group of industry, environmental and business members. DOE is represented on this board and has contributed towards various projects. Industry shares in cost through co-pay requirements.

What are the Fund's Results?

Since the early 1990s, the investments from the state's conservation programs have avoided the need for another 800 MW of power plant capacity – nearly the size of a major nuclear power plant. Consumers saved $1 billion in avoided energy costs – money better used for other purposes. Over the course of the four years from 2000-2003, enough electricity was saved to power 1.8 million Connecticut homes with electricity for a year.

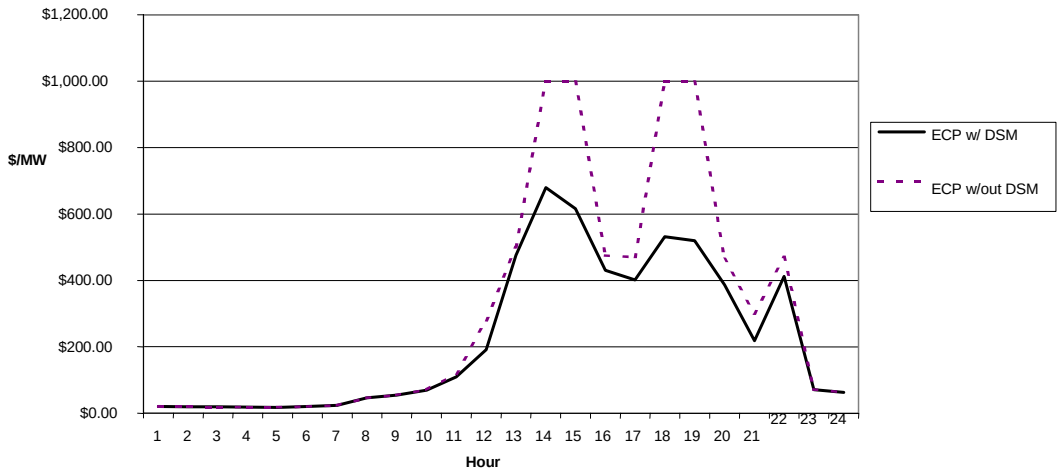


Connecticut Power Plant Capacity Need (Megawatts)
With and Without Energy Efficiency Investments
Source: Environment Northeast

Numerous testimonials exist showing how businesses saved money, increased productivity and in many cases were able to hire more employees.

Importantly, these programs are reducing the total amount of energy needed to meet the demands of the state – a measure of the increase in efficiency and productivity these programs can provide. Studies for the ECMB show that the programs reduce the state's annual growth in capacity demand from 1.7% to 0.6% -- an 80% reduction. In a state facing severe congestion in its transmission system, efficiency has become a major tool in managing stress on the wires. And because of the statutory cost-effectiveness requirement, for every $1 spent the fund produces $4 in benefits in the form of lower energy costs to homeowners and businesses.

Another important effect of energy conservation in a deregulated market is that it can have a dramatic effect on peak pricing. The following chart is from a study by the Massachusetts Department of Energy Resources. It shows that 115 MW of energy efficiency load reductions avoided about $6.7 million in additional costs on the spot market on a hot summer day with high peak demand. (06/07/99)



Impact of Efficiency on Market Prices

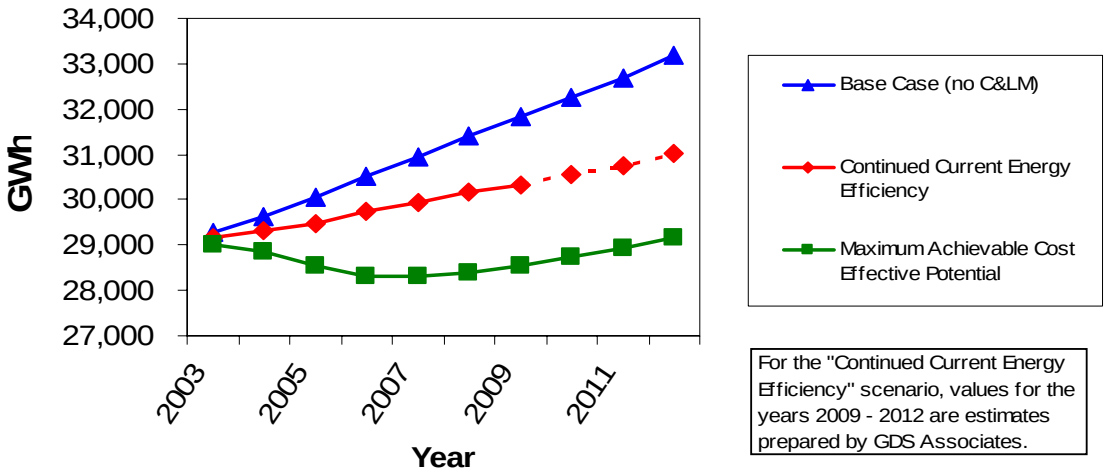
Future Potential

The ECMB has undertaken a study of the cost-effective energy efficiency potential in Connecticut for the future. This report will be released soon. It concludes that capturing the maximum cost-effective potential – not theoretical potential, but what can actually be obtained at low cost with existing technology – will produce the following economic benefits:

- $1.9 billion in savings over 10 years in the form of avoided energy costs
    - $2.8 billion in benefits less $900 million in costs (present value)
- 900 MW avoided capacity
- 4,466 GWh avoided energy consumption by 2012: enough energy to power 600,000 homes
- an average cost of 1.4 cents/kwh.

This graph shows projected trends under three scenarios: no conservation, existing programs and capturing the additional cost-effective potential. This chart indicated that Connecticut can actually achieve level growth in demand – a measure of the amount of efficiency that can be obtained in the system.

Figure 1-2 - Connecticut Energy Forecast (GWh): Base Case, Continued Current Energy Efficiency, and Maximum Achievable Cost Effective Potential



Source: Draft Assessment of Energy Efficiency Potential in Connecticut and Southwest Connecticut, Quantum/GDS Associates

Appliance and Equipment Energy Efficiency Standards

Just over a week ago, Gov. Rowland signed legislation to require minimum efficiency standards for eight commonly purchased products in Connecticut which are not covered by Federal standards. By 2010, these standards will reduce annual electricity demand in Connecticut by 225 gigawatt-hours, equivalent to the electricity consumption of 37,500 households. These reductions mean that:

- Annual electricity demand in Connecticut will be reduced by 65 megawatts by 2010 and by 126 megawatts by 2020.
- Annual greenhouse gas emissions will be reduced by 66,000 metric tons, which is the equivalent of removing 50,000 cars from the road.
- By 2010, Connecticut consumers and businesses will save $40 million on their electricity bills, savings that grow to $435 million by 2020.

These benefits will increase the overall economic productivity in the state.

ISO New England and Congestion

Southwest Connecticut – Fairfield County, Stamford and Bridgeport – has been identified by FERC as one of the top 10 congested areas in the country. Each summer, ISO-New

England, the grid operator, prepares for summer emergency peaks by inviting bids for resources to mitigate the problem. This year for the first time, and we understand for the first time for any grid operator, ISO added efficiency installations as one of the means to address this need in addition to paying customers to reduce their load or installing emergency generators. Approximately 4-10 MW of efficiency improvements were selected to relieve summer congestion. Unlike the other approaches, efficiency produces no incremental emissions and continues to provide savings beyond the period covered by the auction. We hope that this trend of treating efficiency on a level playing field will continue not only in Connecticut and New England but around the nation.

Climate Change Solutions: Efficiency as Low Cost Approach

Connecticut has also adopted a bipartisan approach to addressing the challenges of climate change. Through an intensive 9 month process, stakeholders representing more than 30 business, academic, state agency and environmental interests, including Environment Northeast, met to examine ways Connecticut could reduce its emissions of warming gases. In the modeling upon which that process relied for information, energy efficiency measures stood out as the most economic way to meet greenhouse gas targets. Energy efficiency measures not only produce large emissions reductions, but because they make energy consumption more productive, they provide economic stimulus and offer opportunities for services and manufacturing.

Next Step in Efficiency: Pursue All Fuels Approach including Natural Gas, Oil and Electricity

Tremendous potential exists to develop programs that capture efficiencies across fuel types. If an energy efficiency vendor can treat all fuels in a facility at the same time – ie, reducing heating requirements in a building using oil or gas as the fuel when implementing lighting and other electric efficiency measures – the fuel savings would be large and at lower cost. Environment Northeast has developed information on the benefits of a state program for natural gas and oil efficiency. We estimate programs to invest in natural gas and oil efficiency would produce benefit to cost ratios of approximately 3.0 and 4.0, respectively. Those are indicators of the enormous potential in these areas for lower consumer costs and reduced fuel consumption.

Renewable Energy Potential

Connecticut has also recognized the importance of spurring market development of clean energy sources. The benefits to the state include:

- The need to diversify its fuel sources and avoid over reliance on natural gas – and the corresponding value in reducing exposure to market price volatility
- The need to find effective ways to improve Connecticut's poor air quality
- The opportunity to create jobs from new industries of the future.

The state is pursuing the goal of increasing renewable energy through several mechanisms:

- **State leading by example: Recently, Governor Rowland endorsed a recommendation from a state stakeholder process to purchase 20% of the state's electricity from clean energy sources by 2010, 50% by 2020 and 100% by 2050**. This goal, which has bipartisan support in the state, reflects growing recognition that clean energy sources are needed to improve air quality. But it also recognizes the value in diversifying the state's energy mix. Currently, only 1% of the state's electricity comes from clean sources. Connecticut's dependence on natural gas as a major power plant fuel is growing. In the past, over reliance on oil and nuclear power has left the state vulnerable to price hikes and reliability problems.
- **Renewable Portfolio Standard**: State law requires that sellers of electricity obtain minimum percentages of their power from a defined set of clean energy options.[i] These percentages ratchet up to 7% of the cleanest sources by 2010 and an additional 10% in other renewable sources.
- **Clean Energy Utility Offers**: Connecticut is currently developing the rules for a "green power" option for its utility customers. This will provide consumers an easy check off system to choose clean power and efficiency offers from selected market players. These offers should be in place by the fall.
- **Clean Energy Fund**. The state created the Clean Energy Fund in 2000 to invest in renewable energy companies and technologies. Seen as an industry of the future with employment potential, the CCEF has focused on the state's fuel cell industry as well as investments in other clean power resources.

Federal/State Synergies and Considerations

Current Federal efforts have not accorded energy efficiency the primary policy emphasis which it deserves. One example is the development of appliance efficiency standards by the Department of Energy, which appears to be stalled. The only significant action has been an effort to roll back an air conditioning standard approved by the previous administration, which was forestalled by a federal court ruling on a suit instituted by several states, including Connecticut. As a result, states have been compelled to take the lead with respect to products not covered by federal standards, as discussed above. States cannot, however, increase standards for the many products now covered by Federal standards, even if technological advances warrant improvement. Obviously, it would be far better for DOE to actively pursue opportunities to develop higher national standards where appropriate and cost-effective. Reasonable standards save energy cost-effectively without the need for devoting state and federal program funds to incentives and marketing activities.

An example of positive federal–state synergy is the relationship of the federally funded industrial productivity centers and CL&P's Prime program. Prime provides productivity

audits to achieve greater manufacturing efficiencies through more efficient, streamlined processes and waste minimization. It works closely with ConnSTEP, a manufacturing resource center for Connecticut which is sponsored by the Commerce Department's Manufacturing Extension Partnerships and the State Department of Economic Development. ConnSTEP also works in partnership with the DOE sponsored Industrial Assessment Center at the University of Massachusetts to conduct full facility assessments focusing on conserving energy, reducing pollution, increasing productivity, and reducing costs. The assessments identify energy conservation measures, provide recommendations and estimated costs for implementation, and specify payback periods. ConnSTEP reports that four assessments conducted in Connecticut manufacturing companies during the past year have identified savings of $588,000 in process improvements; 4,153,200 kWh in electrical energy savings; 63,679 MMBtu in natural gas savings and 7.8 million gallons in process water savings. These programs have had considerable success in meeting process productivity and energy efficiency needs in a coordinated manner.

The Energy Star program has also been a valuable ally for state efficiency efforts. EPA has built a credible and well known brand with Energy Star and it has become a powerful force for efficiency. The Northeast Energy Efficiency Partnership has developed regional efforts to promote Energy Star products through advertising, customer incentives, buydowns for manufacturers and distributors and other techniques. The combination of the Energy Star brand and coordinated activity by utility and state conservation programs has produced substantial increases in the purchase of efficient appliances and equipment.

The following are a few suggestions for improving the federal role in promoting energy efficiency.

- Allow efficiency delivery services and programs to qualify for federal funding. It is program delivery that produces actual energy savings.
- Work with a wider group of stakeholders in the states to determine DOE priorities. Federal outreach efforts tend to focus on utilities, other large corporations and state agencies. Consider expanding this outreach to consumer, environmental, low-income and community groups for input on their priorities and perspectives.
- Establish stronger requirements for regional grid organizations to include efficiency improvements as an integral part of their planning and investments.

Additional Opportunities for Federally Sponsored Technology Research

There are a broad range of opportunities to improve the efficiency of equipment and structures. The following are a few that have been suggested by experts in the field.

- More research is needed on installation procedures, tune-up methods and outside air access for commercial air conditioning equipment. The opportunities to reduce summer peak loads are enormous, but the problems are difficult.
- Advanced evaporative cooling technologies could be widely used, but require additional development and testing.
- Daylighting controls and office plug load controls are well along in development, but need more monitoring and analysis to be perfected.
- Heat-pump water heaters present an opportunity for very substantial savings, but have yet to be developed to commercial viability.
- Advanced commercial package refrigeration technologies (coolers, ice makers, etc.) also need development support.
- Promote RD&D on technologies that would further market potential. For example, on-site clean distributed generation combined with efficiency would produce projects that could (i) resize energy load requirements at a customer facility and then (ii) install on-site clean generation to meet load requirements.

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[i] Clean energy sources eligible under the Renewable Portfolio Standard are defined in Conn. Gen. Stat. § 16-1(a) as follows:

(26) "Class I renewable energy source" means (A) energy derived from solar power, wind power, a fuel cell, methane gas from landfills, ocean thermal power, wave or tidal power, low emission advanced renewable energy conversion technologies, a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the river flow, and began operation after the effective date of this section, or a biomass facility, including, but not limited to, a biomass gasification plant that utilizes land clearing debris, tree stumps or other biomass that regenerates or the use of which will not result in a depletion of resources, provided such biomass is cultivated and harvested in a sustainable manner and the average emission rate for such facility is equal to or less than . 075 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter, except that energy derived from a biomass facility with a capacity of less than five hundred kilowatts that began construction before July 1, 2003, may be considered a Class I renewable energy source, provided such biomass is cultivated and harvested in a sustainable manner, or (B) any electrical generation, including distributed generation, generated from a Class I renewable energy source.

(27) "Class II renewable energy source" means energy derived from a trash-to-energy facility, a biomass facility that began operation before July 1, 1998, provided the average emission rate for such facility is equal to or less than .2 pounds of nitrogen oxides per million BTU of heat input for the previous calendar quarter, or a run-of-the-river hydropower facility provided such facility has a generating capacity of not more than five megawatts, does not cause an appreciable change in the riverflow, and began operation prior to the effective date of this section.